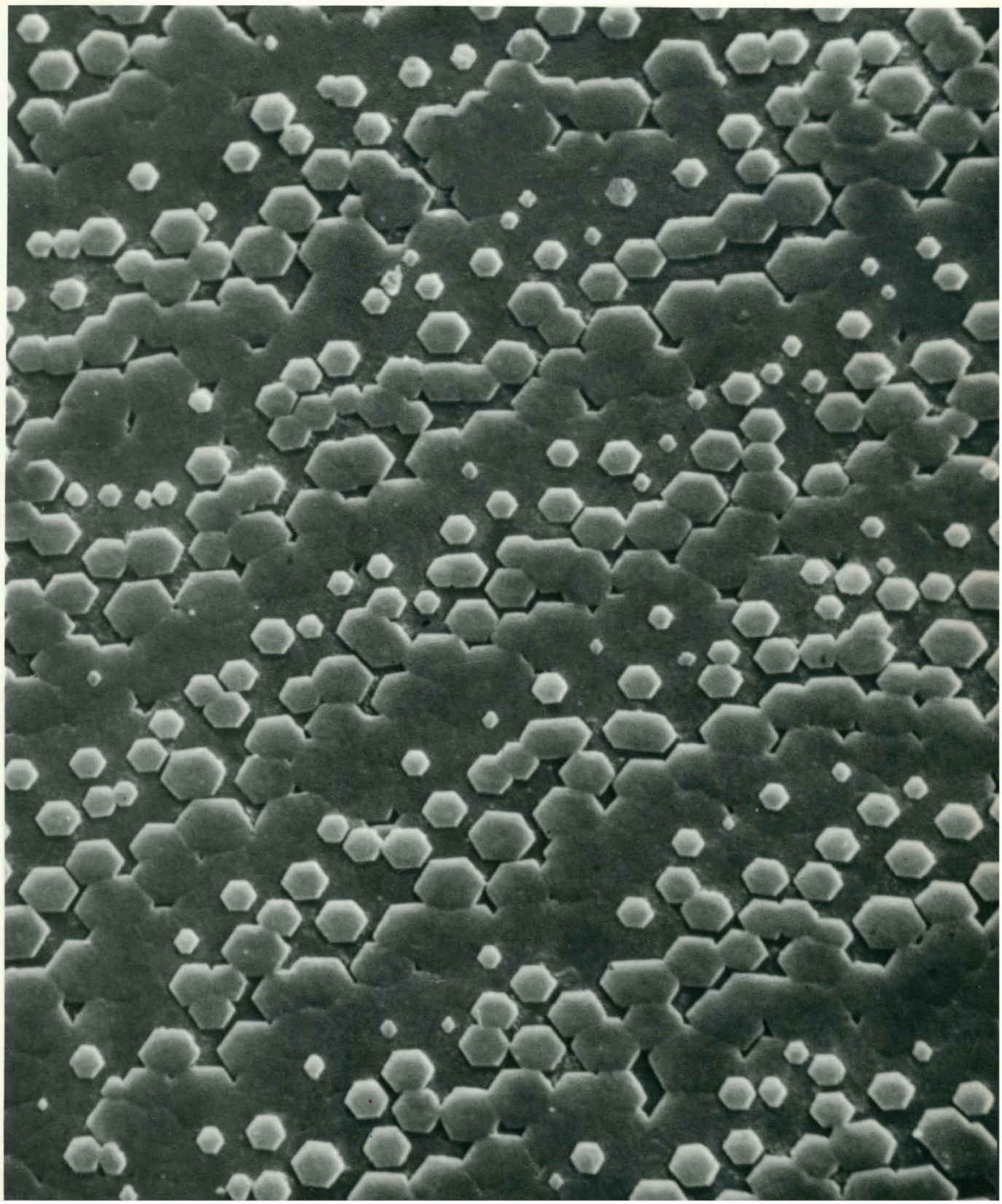
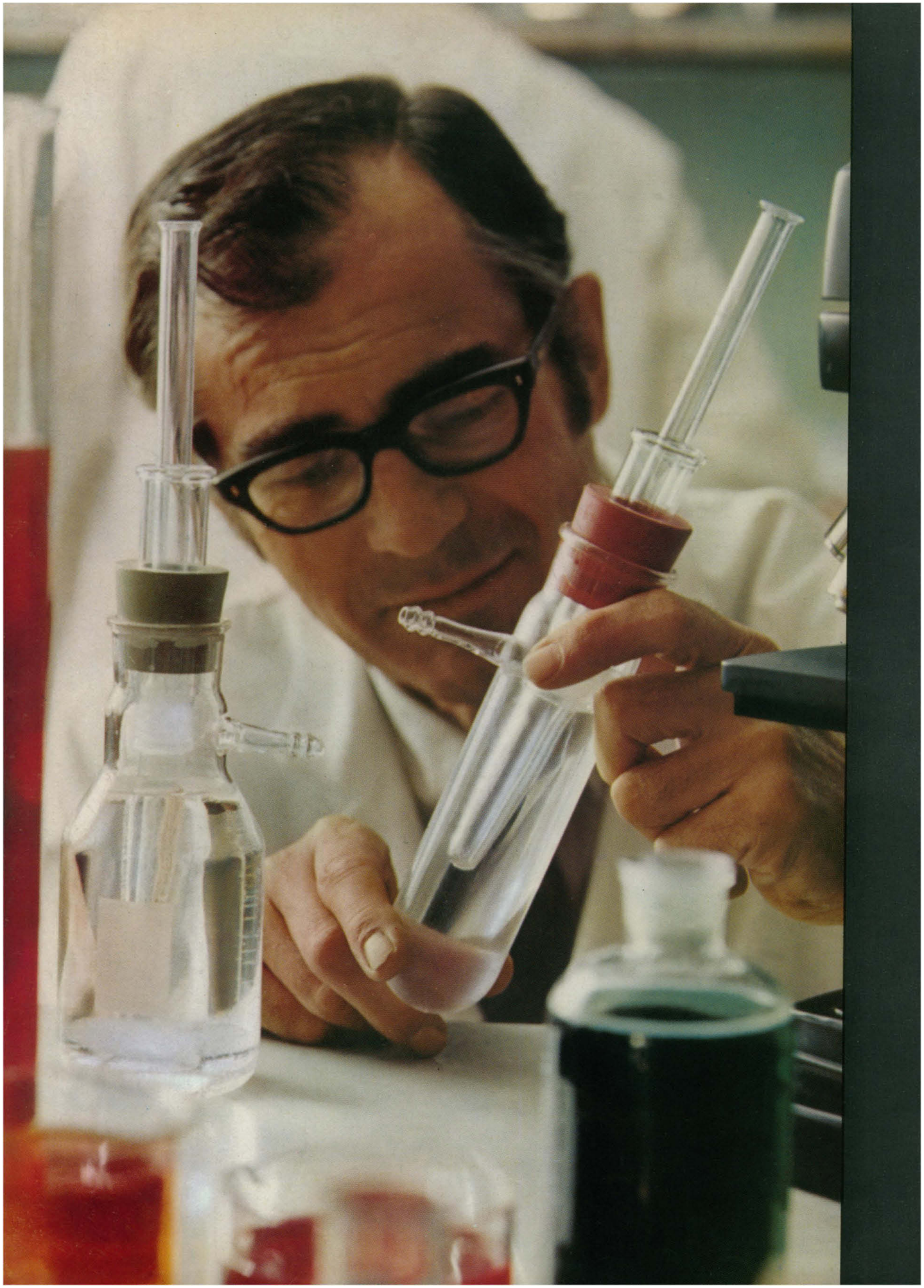
SCIENCE

13 March 1970

Vol. 167, No. 3924

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





13 March 1970
Vol. 167, No. 3924

SCIENCE

SCIENCE is published weekly on Friday and on the fourth Tuesday in September by the American Association for the Advancement of Science, 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Now combined with **The Scientific Monthly®**. Second-class postage paid at Washington, D.C. Annual subscription $12; foreign postage: Americas $3; overseas $5; single copies, 50¢ (back issues, $1) except **Guide to Scientific Instruments** and the 30 January issue, which are $3 each. School year subscription: 9 months, $9; 10 months, $10. Provide 4 weeks notice for change of address, giving new and old address and zip codes. Send a recent address label. SCIENCE is indexed in the **Reader's Guide to Periodical Literature**.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

Growth surface of the nacreous layer in *Pinctada radiata* (pelecypod). New crystals form at the margins of the overlapping mineral laminae (about × 2900). See page 1486. [Sherwood W. Wise, Jr., University of Illinois]

We want to be useful ...and even interesting

Kodak

Contrast enhancement at bargain prices

A mycologist has complained to us about the high price in resolution that is exacted by the familiar optical methods for contrast enhancement in the microscope. To watch living cultures of conidia by time-lapse movies, he needs every morsel of resolution and contrast he can scrounge. His options thin out. He hesitates to blast his faintly stirring conidia with electrons or with light kept on long enough for a good look. He is not the only biologist who can do his looking better by means of a contrast-enhancing black-and-white film responsive to short, moderate bursts of photons repeated at intervals appropriate to the nature of the live material.

Where, then, is the 16mm motion-picture counterpart of the 35mm cassettes of KODAK High Contrast Copy Film recommended to still photomicrographers who want to control contrast photographically?

*Answer: It is masquerading under the name "*RECORDAK *AHU Microfilm 7460, Spec 564." The phone directory in many cities gives a number for Eastman Kodak Company, Business Systems Markets Division. That number can accept your order.*

It can even arrange to include the price of processing by Kodak, if you can accept the contrast to which microfilm is normally developed. This is higher contrast than desirable for general photography, but it proved just right for our friend's conidia.

Thus the business world's need for microphotography* saves the scientific world from paying for the cost of bringing out a high-contrast movie film for photomicrography.* The $100 minimum order buys enough film for an ambitious research program.

*See the distinction between these two oft-confused nouns?

Why we bother with scientists

Not always does it turn out (*as above*) that the right sensitized product sits awaiting call to service.

As the laboratory and the observatory escape confinement to earth's atmosphere, many and varied are the calls we get for photographic receptors hitherto neither needed nor dreamt of. Challenge has long made a fine subject for commencement orations, but some of the challenges in the day's mail must simply fatten the file labeled "Something to Think About." The rest provide something to think about sooner.

Scattered among the challenges we encounter compliments from satisfied space scientists, happy with results from new films and plates we have devised for them without aid and comfort from R&D contracts.

Typical recent cause for happiness: doubling the best previous resolution of solar images in the 30-nm spectral region.

Innate nobility of character is only one reason we mount a continuing program in the Kodak Research Laboratories to serve the cutting edge of science with new photographic needs. Another reason discovered long ago still holds. Work for science sharpens the wits, the better to deal with less stringent technical demands.

Don't ever hesitate to make stringent demands for photographic materials to Eastman Kodak Company, Scientific Photography Markets, Rochester, N. Y. 14650. We can always reply that your demands are outrageous, if they are.

And so (*as above*), we relentlessly charm the world into ever stronger embrace of photography. The consequences of success in this endeavor require careful consideration.

Embracing photography just for fun has led legions into serious livelihoods. Though photography for fun keeps its popularity, neither the fun in this day of color photography nor the serious work typically concludes with dumping two little trays down the drain. No great need for concern there. The concern, business and personal, of one segment of our intramural technical community gravitates to the drains from places where sizable volumes of our films and papers meet our processing chemicals to produce the images we have induced the customers to want.

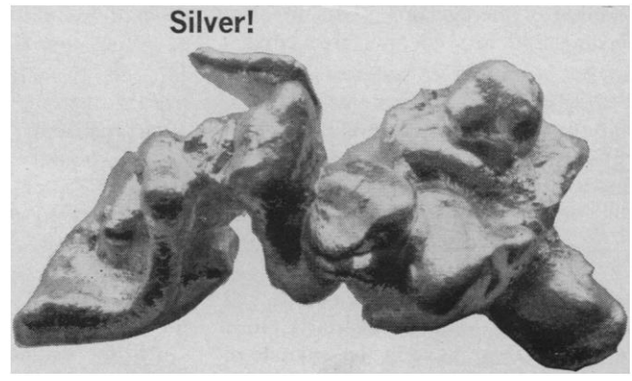
More than imagery is produced. The drains lead somewhere that is everybody's business, and properly so. A little black box is not ready to receive spent developer and fixer and regenerate them for return to the processing machines. A computer program *is* ready for activation through the Kodak Technical Representative. For any process we recommend, it tells the customer's engineers the concentration of effluent compounds and ions that will have to be broken down or precipitated out to meet standards that fish and informed public opinion can tolerate.

In formula improvement, high biodegradability is the short-range goal. The long thrust aims at low oxygen demand and low toxicity of ingredients and reaction products.

Need for rapid access to photographic results has brought harder emulsion than formerly. This yields a bonus. With less sensitivity to emulsion abrasion, squeegees now retain fixer formerly lost to the sewer. Not only is fixer comparatively high in biological oxygen demand, but it costs money.

Another simple way to make concern for the environment pay a cash dividend is to bubble CO_2 into the Kodachrome film developer. This precipitates valuable dye coupler compounds for reuse.

Far less film—of whatever kind—needs to be processed to make it pay to remove a component of the effluent that is 1) the miraculous foundation of photography, 2) a pollutant of ground water, 3) a scarce resource getting scarcer, 4) a Scripturally recognized motivator of men for good and evil, and 5) the subject of a carefully assayed and constantly updated credit allowance when a replaceable unit is returned to us from an attachment to the laboratory plumbing that you can find out about from Department 919, Eastman Kodak Company, Rochester, N.Y. 14650—



SO OTHERS MAY BREATHE EASIER

Breathing is a pretty-much taken-for-granted activity. Until it stops. Or until you look into the efforts of researchers and physicians in that field. Measuring respiratory pressure and volumetric-flow rate is pretty straight-forwardly accomplished with conventional transducers. But there are other important parameters that are determined by these characteristics: total inspired volume and breath-by-breath volume. Then there's total work, compliance and respiratory resistance. All of these values used to have to be calculated by hand. Tedious and time consuming. More lately they were cranked into a digital computer. Less tedium, but still a delay. Now, thanks to EAI analog computers, all calculations can be accomplished instantaneously and presented simultaneously with the original measurements on a strip chart. Besides the obvious value of showing a researcher what's happening when it's happening, our lower-cost machines also open new doors to monitoring patients. We've got some dramatic stories on how EAI analog computers are helping in other areas of research into physiological dynamics. By writing to "Bio-medical", Dept. 206M, you'll get them by return mail.

GC PEAKS AND THE SOFTWARE DEMON

As with motherhood and the flag, consensus holds that computerized data acquisition is with us to stay. But, in practice, it all can get a bit sticky. Take data from an analytical instrument like a GC. A few giants in the industry continue to stumble over problems in GC like noise, signal processing, or really useful software. EAI is still the pioneer here in its PACE analytical data system. One seemingly small thing is a software technique for resolving complex GC peaks. It consistently and accurately apportions complex areas, ranging from overlapping components to poorly resolved shoulder peaks. Part of the technique accommodates the usual "skew" in component elution to give consistent improvement in accuracy of quantitative analysis. (Our research people gave a paper on it at the 158th National ACS meeting.) It's all part of the whole PACE system--a turnkey data system for many analytical instruments--GC, mass spec, and the like. For a copy of the paper and a detailed booklet write to "PACE", Dept. 206M.

IMITATION POLLUTION CAN BE A SOLUTION

A topic certain to stir up the citizenry these days is pollution--any kind of pollution. Take a simple thing like free oxygen in water. Overload the water with oxygen-hungry chemicals--no oxygen. Or develop too many organisms--plant life prospers (called eutrophication) and no oxygen. Either way, no fish. And with no fish, you've upset the water ecology. Pragmatic scrutiny tells us we can't shut down our industries to bring back pristine, airy waters. Fortunately, we can imitate these conditions by computer simulation, and get a grip on the ameliorative aspects of a solution.

Recently, EAI provided the HEW with a hybrid-computer simulation of the Delaware River Estuary. From this simulation engineers can tell where to best locate stand-by reservoirs, what flow rates to employ, and when to use them. We've written this one up. A request to "Delaware", Dept. 206M, will get you a copy, and get us both cracking on another solution.

KINETIC DATA MEANINGFULLY SHAPED BY COMPUTER

In olden times petrochemical-process design involved finding rate and equilibrium constants for several reactions required a trial-and-error method. Much trial. Much error.

Most process designs involve the solution of ordinary differential equations --in a lumped-parameter system where changes are taking place in time but not space. With the use of analog computers, solutions poured forth. However, distributed parameter systems involve changes in time and space simultaneously--expressed by partial differential equations. Many approaches to PDE solution have evolved for digital computers. But such solutions consume more and more hardware, with ever-present error creeping back in as problem complexity increases.

Hybrid computers clear this difficulty up. Kinetic data are programmed into the analog portion, actual results go into digital computer memory. The analog makes a series of process condition runs, the digital stores the data, matches the results from the plant and computes least mean-square deviations. The "solution" has been found when results of simulation most closely match actual conditions, and no further reductions can be made in mean square deviation values. Optimization is achieved--in time, money and results.

After much struggle, EAI is pleased to offer a software package in this arcane speciality--write to "Kinetic", Dept. 206M. Electronic Associates, Inc. West Long Branch, N.J. 07764.

13 March 1970, Volume 167, Number 3924

SCIENCE

Concern for the Next Generation

The President's message of 3 March on education and his call for the establishment of a National Institute of Education modeled after the National Institutes of Health raise several kinds of issues. Have the Kennedy and Johnson educational programs been as ineffectual as he claims? Is the call for more studies instead of more money a stalling tactic? But improvements are needed; a sounder understanding of early childhood development is necessary to guide compensatory education programs; and insistence upon better standards for judging school performance is sound policy, despite expected protests from those who prefer faith, hope, and charity over facts as criteria for evaluating their own work.

Although it has been known for 40 years that children are already typed intellectually and socially by the time they enter the first grade, it has only been with the changing priorities of recent years that national attention has been given to the critical importance of a child's early years in determining his later development. There is now widespread concern, but a sense of direction is needed. Perhaps we can gain a better perspective on our own objectives by looking at what others have done. That cross-national studies can be illuminating is demonstrated by Urie Bronfenbrenner's comparison of the education and socialization of children in the United States and the U.S.S.R.* In the U.S.S.R., the strategy of nurseries, schools, and youth organizations is to emphasize sharing, collective responsibility, group solidarity, and group control of individual behavior. The child is deliberately brought up "in the collective, by the collective, and for the collective." Groups (a row, a class, a school) are praised, blamed, rewarded, or punished. A child who individually does well is helping his group; one who shirks is betraying his group. Thus the school leads children to conform to established standards, to work toward group goals, and to control each other in these efforts.

Peer influence is also strong in the United States, but its nature is not so carefully planned nor are school practices designed to direct it. Although we respect "togetherness" in the family, increasingly we practice "apartness." Children spend more waking time with their age mates than in the family, and more time with television than in school. Both of these influences are often at variance with norms of desirable personal and social behavior.

As a result of these two approaches, at age 16 the Russian youngster is a product of planned and managed development aimed toward Communist morality, while his American counterpart is a product of the uncoordinated influences of family, school, 12,000 to 15,000 hours of television (much of it violent), and the increasing pressure of other children whose attitudes and interests have been similarly formed. As an illustration of the difference in results, Bronfenbrenner found that American children were more likely, and Russian children less likely, to engage in dishonest or antisocial behavior if other children were going to know what they had done. Correspondingly, Russian children seem to have less individual initiative and resourcefulness than American children.

By our standards, the U.S.S.R. has been too concerned about making the next generation conform. But we have not been concerned enough. If the proposed National Institute of Education is established, its responsibility will be no less than that of providing national guidance in translating a now aroused concern for the next generation into effective and constructive improvements in their preparation for adulthood.

—DAEL WOLFLE

* *Two Worlds of Childhood: U.S. and U.S.S.R.* (Russell Sage Foundation, New York, 1970). Dr. Bronfenbrenner's work was supported by the National Science Foundation, the Russell Sage Foundation, and Cornell University.

year's meeting recevied partial support from The Population Council as well as from various commercial sources. It was organized, as before, by H. P. Klinger. Approximately 50 people attended. The participants thank Professor G. Stalder, medical director of Children's Hospital, who served as host, and the City Council of Basel for hospitality. There are no printed proceedings.

SALOME GLUECKSOHN-WAELSCH
Department of Genetics,
Albert Einstein College of Medicine,
New York 10061

Calorimetry

Calorimetric techniques and their applications were discussed at the 24th Calorimetry Conference, held at the Wentworth-by-the-Sea near Portsmouth, New Hampshire, 14–16 October 1969.

The Huffman Memorial Lecture is a feature of the conference and is presented by a man selected on the basis of excellence in thermochemistry and thermodynamics. In 1969 the address was given by Ward N. Hubbard (Argonne National Laboratory), leader of a group engaged in fluorine combustion calorimetry. Hubbard summarized the heat of formation data obtained for some 30 fluorides by direct combustion of the elements in fluorine; he discussed the periodicity of derived bond energies when plotted against atomic number of the central atom. The plot also served to indicate where additional data are needed.

Reports were made on measurements of specific heat at low temperatures and their interpretation in terms of phenomena such as phase transformations in alloys and organic compounds, magnetic ordering in ferrous molybdate and tungstate, antiferromagnetism of $DyPO_4$, and molecular motion in clathrates and polymers. The effect of isolated heavy impurity atoms in a light host lattice was discussed at the 1967 Conference; measurements have now been extended to higher temperatures and higher concentrations to test theoretical explanations. Papers on the specific heat of liquid helium provided tests of theoretical predictions of the interaction potential between He^3 atoms and critical point behavior of He^4. Difficulties in measuring the heat capacity of plutonium carbide due to self-heating were described.

A continuing concern of thermochemists is the accuracy of experimental methods; several papers offered data affording cross-checks by different approaches. The rotating bomb method for heat of combustion of organic chlorine and bromine compounds was checked against solution thermochemistry by means of the hydrochloride and hydrobromide of trishydroxyaminomethane (THAM) at the Thermochemical Center, Lund, Sweden; results were in good agreement. The enthalpy of neutralization of THAM with aqueous HCl has been proposed as a standard exothermic reaction for solution calorimetry; a series of researches at several locations was reported by S. R. Gunn which related this quantity to the long-established heat of combustion of benzoic acid. A direct measurement of the enthalpy of neutralization at the National Bureau of Standards is not in agreement to the desired degree; further work is apparently needed. A new determination was made at Argonne National Laboratory of the enthalpy of formation of aqueous HF by means of the enthalpy of reaction of fluorine and hydrogen to form liquid HF combined with the enthalpy of solution of liquid HF in water. The result did not agree within experimental error with recent data by other approaches; a selected value satisfactory to all is not yet established. New data on a Calorimetry Conference specific heat standard, Al_2O_3, were reported from the National Bureau of Standards.

New equipment which was described included data acquisition systems for low-temperature specific heat calorimeters, a solution calorimeter, a liquid nitrogen boil-off calorimeter, and solution, titration, and mixing calorimeters. A high precision water bath (Tronac, Inc., Orem, Utah) achieves a long-term stability of 0.0003°C. A microcalorimeter developed at the University of Colorado was applied to the study of the myoglobin oxygen reaction with impressively precise results. A design for miniature platinum resistance thermometers for low-temperature calorimetry was approved and a manufacturer is now being sought to produce such thermometers commercially.

Information about the 25th Calorimetry Conference may be obtained from E. D. West, National Bureau of Standards, Boulder, Colorado.

G. C. SINKE
Thermal Research Laboratory,
Dow Chemical Company,
Midland, Michigan 48640